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ABSTRACT

This report discusses the challenges of preparing a nation of learners to address the skills deficit for high-performing jobs and innovations in the future. A nation of learners is one that effectively and efficiently helps students achieve proficiency in the basic, lifelong skills, and also provides ongoing education and training tailored to individual and workplace needs. To increase the effectiveness of learning, educators must provide more engaging relevant content targeted to individual styles of learning and needs. The Business-Higher Education Forum (BHEF) recommends a bold new commitment to the U.S. learning future through the creation of a Presidential Commission on Learning. This high-level commission can enable the country to meet the needs of a new generation of learners, unlock the learning potential of each student, and ensure the competitive future of the United States. The BHEF urges policy makers to steer the United States into a new era of learning by taking several specific and critical steps in two key areas: developing new leadership and vision and focusing on learning redesign and dissemination. New regional innovation centers for learning redesign also should be created to develop best practices, disseminate learning solutions, help with the redesign of education, and underscore the role of technology. (SLD)

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The Need for Changes in Teaching and Learning to Meet Global Challenges

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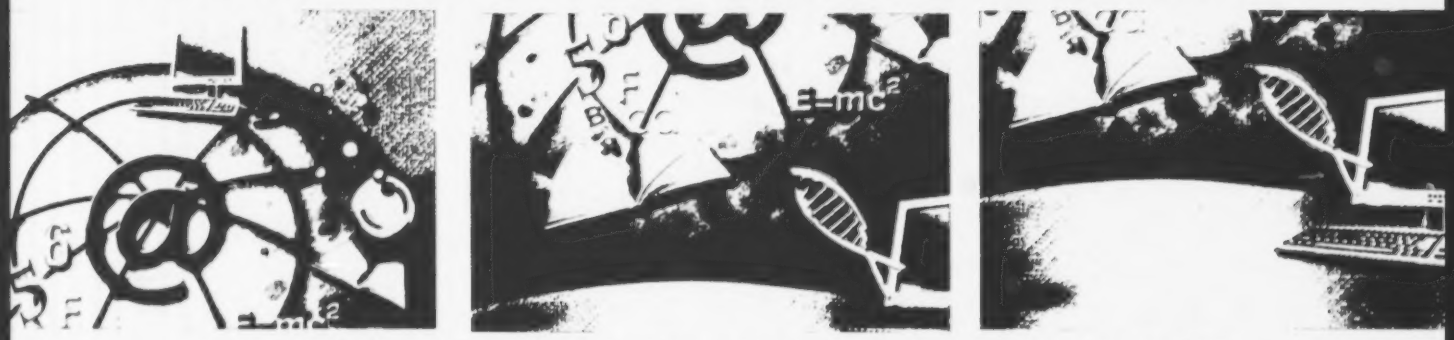

THE NEED FOR CHANGES IN TEACHING AND LEARNING TO MEET GLOBAL CHALLENGES

BUSINESS–HIGHER EDUCATION FORUM

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Preface

For America to compete in today's global economy, we must ensure that students develop the skills they need to take them from the classroom to the boardroom. We must become a true "nation of learners."

This will require systemic change. Our higher education institutions must adopt bold new approaches to learning and teaching. We must become more responsive to the needs and talents of both students and teachers alike, and more effective in cultivating America's leaders of tomorrow. Key to that change, as this report shows, is the effective use of information technology.

In 1999, the Business–Higher Education Forum (BHEF) issued *Spanning the Chasm: A Blueprint for Action*. That seminal report identified the core set of skills that business leaders now require of university and college graduates in order for their companies to compete successfully in the global marketplace. In the few years since that report appeared, information technology has emerged as a powerful transformational tool in teaching and learning, promising more positive learning outcomes throughout higher education.

As co-chairs of BHEF's Learning and Technology Initiative, we appreciate and value the growing contributions of technology-based learning to the education and training of our nation's students. We know that U.S. businesses can become more competitive, both at home and abroad, if we take full advantage of the varied tools that this new learning strategy brings to the teaching and learning experience. We are both heartened by the potential benefits of this learning transformation and challenged by the daunting scope of investment and adaptation required to create a true nation of learners.

In preparing this report, BHEF sought input from business and university leaders across the nation and worked to identify exemplars in learning innovation. We discerned a heightened sense of urgency and found wide consensus for the need to build a workforce fully equipped with the lifelong learning skills needed to compete globally. Building such a nation of learners, however, will require strong conviction and sustained commitment that spans the sectors of education, business, and government. As outlined in this report, we urge public policy makers at the local, state, and national levels to take up this challenge and make the investment needed to usher in a new era of learning.

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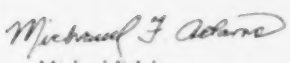

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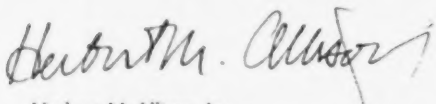

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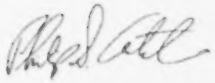

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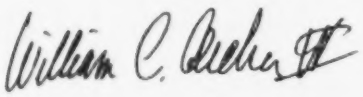

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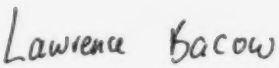

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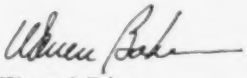

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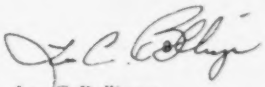

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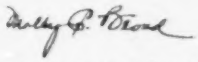

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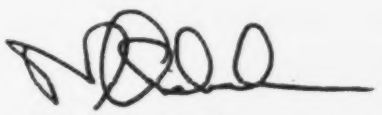

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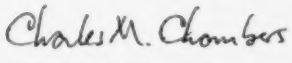

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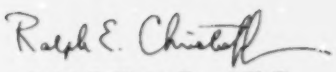

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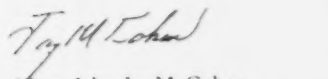

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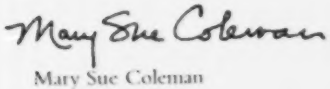

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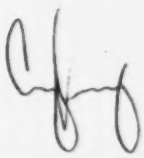

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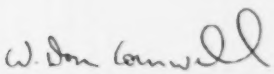

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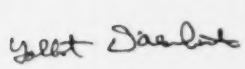

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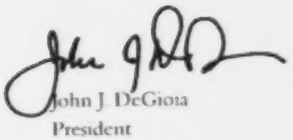

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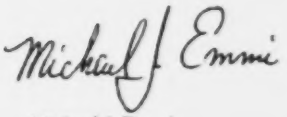

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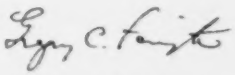

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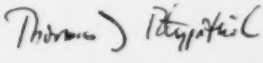

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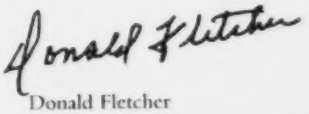

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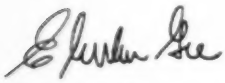

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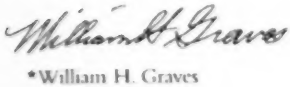

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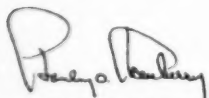

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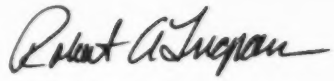

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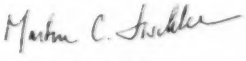

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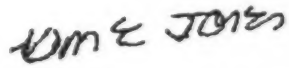

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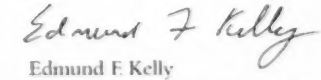

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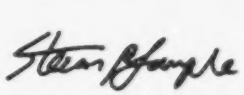

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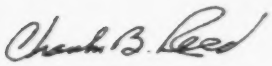

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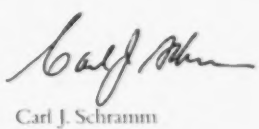

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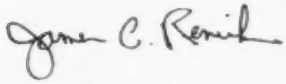

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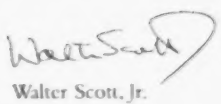

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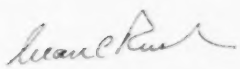

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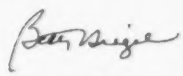

Betty L. Siegel
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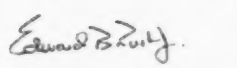

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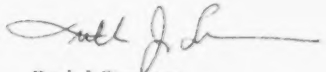

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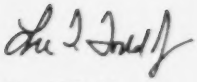

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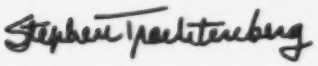

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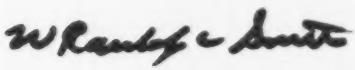

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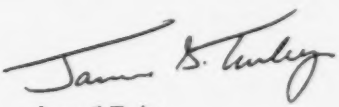

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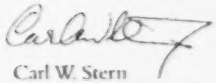

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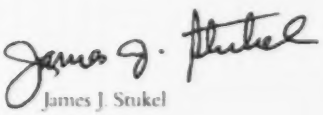

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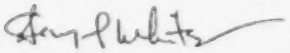

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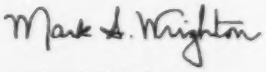

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Executive Summary

Over the past decade, both the education and business communities have become increasingly concerned about America's global economic challenges. In particular, business and education leaders have focused on the widening "skills gap" between traditional training and the skills actually required to do today's jobs and those of tomorrow.

In 1999, when the Business–Higher Education Forum (BHEF) updated its 1997 *Spanning the Chasm* report with a blueprint for action, BHEF was concerned about how to better prepare college graduates for future jobs. The BHEF report found that although college graduates still will need to complete coursework and training targeted to specific professions or jobs, today's high-performance job market requires graduates also to be proficient in such cross-functional skills and attributes as leadership, teamwork, problem solving, and communications.

Now, four years later, BHEF reports a heightened sense of urgency in addressing the "skills deficit." To better prepare for the challenges of the high-performing jobs and the innovations of the future, all sectors of society must work together to build a nation of learners equipped with the key skills needed to succeed, including those that transcend specific job categories.

A nation of learners is one that effectively and efficiently helps students achieve proficiency in the basic, lifelong learning skills and also provides ongoing education and training tailored to both individual needs and workplace demands.

To respond to the demographic, economic, and social forces affecting education and the workplace, America's higher education institutions need to adopt new approaches to learning.

Educators are supporting changes to higher education that are more responsive to the individual learner and more effective in achieving the desired educational outcomes. To increase the effectiveness of learning, educators must provide more engaging, relevant content targeted to individual styles of learning and needs. Some institutions of higher learning are already doing just that. But solutions must be scaled to a wider range of learning environments. To achieve change on the scale needed, BHEF recommends a bold new commitment to the nation's learning future—the creation of a Presidential Commission on Learning, comprising representatives from Congress, the private sector, education, state and local government, and representatives from the Departments of Commerce, Labor, Education, and other relevant agencies.

This high-level commission can enable the country to meet the needs of a new generation of learners, unlock each student's learning potential, and ensure America's competitive future. To accomplish this, the United States needs major investments in new models of learning, while at the same time recognizing the important role that technology can play in helping create the infrastructure to support the necessary changes on a broader scale.

BHEF urges policy makers to steer the United States into a new era of learning by taking several specific and critical steps in two key areas: developing new leadership and vision, and focusing on learning redesign and dissemination. Before the end of 2004, the new commission should present to the president a strategic plan for reaching these educational goals and quantifying the investment needed to reach them.

New regional innovation centers for learning redesign also should be created to develop best practices, disseminate learning solutions, help with the redesign of education, and underscore the role of technology. In addition, BHEF proposes the creation of a new federal Learning and Networking (LAN) Grant Program to help universities, colleges, and community colleges champion education redesign.

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"Absent reforms that allow us to produce and distribute education cheaper, faster, and better... we may not be able to afford all the education we need to maintain our competitive position or to reduce the widening gap in earnings between th most and least educated."

—Carnevale & Descrochers, 2002

The Nation of Learners Challenge

Few people would disagree that knowledge, innovation, and an educated workforce represent the critical components for sustainable advantage in the fast-paced global economy. During the last 15 years, a plethora of studies and reports have issued calls to action highlighting the dramatically changing educational needs of workers and the resulting challenges created for educators and policy makers alike.[1] Not only do these issues still ring true today, but also the challenges have become accelerated and more acute.

Nearly 20 years ago, the groundbreaking report, *A Nation at Risk*, issued a call to action for increasing the effectiveness of the U.S. educational system. Today's global challenges have made education even more important and demand a similar national response.

The stakes could not be higher. Education no longer determines just the competence of the individual in the marketplace, but also the ability of the nation to secure and maintain a workforce and compete globally.

BHEF appeals to America's leaders in the government, business, and education sectors to renew their commitment to create a nation of learners and to recognize the role higher education can—and should—play in making that happen.

SKILLS AND ATTRIBUTES OF A NATION OF LEARNERS

During the last few years, BHEF, which includes business leaders, educators, researchers, administrators, and other major players in business and education, has identified the cross-functional skills and attributes that college graduates need to compete in the workplace.

In BHEF's 1997 report, *Spanning the Chasm*, American companies reported that many college graduates were lacking in nine key attributes necessary for today's high-performance jobs: leadership, teamwork, problem solving, time management, self-management, adaptability, analytical thinking, global consciousness, and basic communications skills (listening, speaking, reading, and writing).

A higher education system more attuned to enhancing these reasoning skills and leadership attributes must be implemented to build a nation of learners and to prepare a workforce for the future. Students cannot attain these critical skills simply by turning on a computer, watching a video, or passing a test. These crucial skills will not be transferred to higher education students without a sophisticated, highly adaptable education system.

"The way we organize schools and provide instruction is essentially the same as it was when our Founding Fathers went to school. . . . We still educate our students based on an agricultural timetable, in an industrial setting, yet tell students they live in a digital age."

—U.S. Secretary of Education Roderick Paige

When the United States becomes a nation of learners, students will be trained to assess complex situations, solve problems, and work with others in response to a range of unpredictable global challenges.

SKILLS AND ATTRIBUTES OF A NATION OF LEARNERS

Leadership

Teamwork

Problem Solving

Time Management

Self-management

Adaptability

Analytical Thinking

Global Consciousness

Basic Communications

SOURCE: The Business-Higher Education Forum, *Spanning the Chasm: Corporate and Academic Cooperation to Improve Workforce Preparation*, 1997.

WHAT'S AT STAKE FOR THE COUNTRY

The United States cannot put off the challenge any longer. The knowledge and skills gap already in place will only get worse, creating even more barriers in the future.

The shortage of workers with some college-level skills could reach more than 12 million by 2020, according to a 2002 report prepared for the U.S. Department of Education.[8] Seventy percent of CEOs consider the difficulty of finding and retaining skilled workers a barrier to growth—a concern that has doubled in only five years.[9] U.S. companies reported in one 1999 study, for instance, that four out of 10 applicants tested for basic skills lacked the necessary reading, writing, and math skills to do the jobs they sought—twice the amount of only three years earlier.[10]

Baby-boomer retirements during the next 20 years will have a major impact on workforce preparedness. Not all of these vacated jobs are skilled jobs, but the nation is, nonetheless, on the verge of a critical shortage of workers with college-level skills. Employers must fill high-performance jobs somehow. If they cannot attract skilled employees at home, they will be required to look overseas, which could have a major economic impact on the United States.

On the other hand, if the country can provide a workforce proficient in the learning skills needed to adapt to job changes, enormous economic benefits will result. Countries that can produce and fill the faster-growing, higher wage, information- and knowledge-intensive jobs are the countries that can innovate, thrive, and grow in the global economy. One study, for example, suggests that if the skills distribution in the United States matched that of Sweden, the U.S. gross domestic product (GDP) would grow by an astounding $463 billion.[11]

More than economic well-being is at stake. A country that can meet its labor needs with a well-prepared workforce is a secure nation. The military and government sectors have already expressed concerns about the impact of an underutilized and undereducated workforce on national security. Creating a nation of learners is not only an economic issue, therefore, but also a national security issue. As Chief of Naval Research Jay M. Cohen puts it:

> *"For over a quarter of a century, the freedoms Americans enjoy have been defended by an all-volunteer armed forces. Today, as we face an uncertain world, the strength of our nation—intellectually, economically, and militarily—will be based on a highly motivated, technically trained population. That strength will only be as great as our commitment to learning and excellence in education."*

WHAT'S AT STAKE FOR THE INDIVIDUAL

Building a nation of learners will have an impact not only on the nation's economy and national security, but also on each individual's future. Education can be the key factor in influencing how much individuals earn and whether or not they have access to the constant retraining needed to respond to change. The U.S. economy now has the largest income premium for college-educated workers among the world's most advanced economies.

The income difference between those with higher education experience and those without has more than doubled in less than 20 years.[12] Although the relative earnings of the least edu-

cated workers are falling, the wages of workers with postsecondary education have increased. Compared to a high school degree, for example, an associate degree is worth nearly half a million dollars in extra income; a bachelor's degree, another $1 million; a master's degree, $1.1 million; and a doctoral degree, more than $3.2 million in increased earnings.[9]

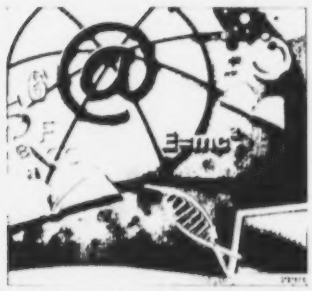
In the future, the livelihood of the individual will be even more dependent on skills and education with the increased need for all members of the workforce to be better skilled, better educated, lifelong learners. In 1950, 80 percent of jobs were classified as "unskilled." Now, an estimated 85 percent of jobs are classified as "skilled," requiring education beyond high school. At the same time, 60 percent of future jobs will require training that only 20 percent of today's workers possess.

Even if employees are equipped for today's jobs, they need to be ready to learn, re-learn, and in some cases, unlearn to respond to corporate downsizing, workplace modifications, and other realities. It is expected that people will be changing jobs at least 10 or 15 times during their working lives and have three or more career paths.

Given the tremendous pace of change, it may be impossible to predict exactly what these jobs of the future will look like. As it is, few people predicted the massive changes in the work environment and the home that resulted from the personal computer and the information age.

Nevertheless, educators and business leaders do know what is necessary for workers to be prepared for the unexpected: ensuring that graduates attain proficiency in the crucial skills identified by BHEF. Individuals who are adept in basic analytical and communication skills will have a strong foundation upon which to draw when challenged to accept new job tasks.

With a workforce equipped with these lifelong learning skills and attributes, the United States and its individual citizens will be in a strong position to meet the unexpected challenges of the future.



Today, as we face an uncertain world, the strength of our nation—intellectually, economically, and militarily—will be based on a highly motivated, technically trained population. That strength will only be as great as our commitment to learning and excellence in education.

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"If we are to remain preeminent in transforming knowledge into economic value, the U.S. system of higher education must remain the world's leader in generatin scientific and technological breakthroughs, and in preparing workers to meet the evolving demands for skilled labor."

—Federal Reserve Board Chairman Alan Greenspan, 2000

Changing Education to Build a Nation of Learners

Just as a workforce equipped with the critical skills holds the nation's hope for the future, education presents the path toward achieving that goal. As this paper outlines, while many educators expend considerable effort revisiting the question of how best to teach their students, the need for a fundamental systemic change in learning and teaching remains crucial in order to achieve a nation of learners. To obtain the broad analytical skills required, as well as the specific job-driven skills in demand, students need programs and courses that are both more individualized and better able to produce measurable results and standards. At the same time, education must challenge students to become flexible in their approach toward learning so that they can adapt to new work environments or upgrade job-related skills as career needs—and careers themselves—change.

Some educators are calling for a redesign of education, to align its standards with these challenges. BHEF has identified five key changes that can help redesign education to produce graduates prepared for the 21st century. These include:

- Focusing education on the lifelong learning skills and attributes needed for a nation of learners.
- Creating content that is challenging, motivating, and relevant.
- Encouraging learning through more interaction and individualization.
- Increasing opportunities and access to education.
- Adapting objectives to specific outcomes and certifiable job-related skills.

FOCUSING EDUCATION ON SKILLS AND ATTRIBUTES

The lifelong learning skills and attributes noted in *Spanning the Chasm*—leadership, teamwork, problem solving, time management, self-management, adaptability, analytical thinking, global consciousness and communications—need to be firmly embedded in teaching at colleges, including community colleges, and universities. When evaluating courses, programs, and styles of teaching, educators need to address questions such as: How do programs improve student leadership abilities? What kinds of multidisciplinary courses enhance analytical thinking? What learning experiences can help students become aware of global concerns and responsibilities? How can course requirements and exams enhance communication skills, both oral and written?

A successful redesign of education can help educators begin to answer these and other questions. Redesign is not limited to one discipline or field of study, as the standard expectations for virtually every job in the world continue to rise. Previous job requirements for an accountant, for example, were fairly straightforward: knowledge of accounting theory and attention to detail. Today's accountants, however, need to be computer-savvy, conscious of world issues, team players, and able to communicate ideas, both orally and in writing.

CREATING CHALLENGING AND RELEVANT CONTENT

As educators and administrators become more attuned to the need for students to graduate with proficiency in the newly identified skill sets of the 21st century, educators will need to review how they teach students as well as what they are teaching. In schools, libraries, and homes, animation, collaboration, and other techniques are used frequently to make learning more fun and engaging for a range of learning styles—all through technology.

User-friendly models of learning can make learning not only more fun, but also more efficient and effective. Thanks to new learning techniques, students can "immerse" themselves in virtual worlds, whether traveling through time back to Colonial days, simulating heart surgery, or journeying to Africa to experience health crises firsthand.

Both the Congressional Web-Based Education Commission and the Department of Commerce have drawn attention to the need to improve the quality of web-based learning content.[viii] Although much of this content will still come from traditional sources, such as textbooks, journals, and periodicals, instructors will play a key role in pulling together various types of content and supplemental material from a variety of sources, and in a variety of formats. Faculty will supplement traditional textbooks with resources that have been digitized, including video, voice, and data, to create multimedia content that challenges students to interpret and relate as aspiring leaders to events, situations, and problems from a range of academic disciplines and perspectives.

INTERACTIVE AND INDIVIDUALIZED LEARNING

Research shows that if students experience a high level of interaction with content, the rate of motivation and retention increases, and learning improves. Learning by doing is an important tool for the redesign of education to help students learn quickly and retain concepts. The traditional style of "lecture, listen, and learn" needs to be replaced with a more active style of learning that emphasizes reasoning, interpretation, and problem solving. Interactive educational methods include those between teacher and student, among students, or between the student and an interactive learning tool.

Since the introduction of the first individual tutors centuries ago, individualizing and personalizing learning has been an educational ideal. Traditional education tends to engage all students in the same set of activities regardless of individual abilities, preferences, or needs. Individualization provides learners with access to instructional materials matched to their learning needs and styles.

In the redesign of education, higher education teachers will be able to more easily access these methods of teaching and learning, and reach greater numbers of students.

INCREASING EDUCATIONAL OPPORTUNITIES AND ACCESS

Today, more learners are demanding flexible education that can be delivered anytime, anywhere. Learning is no longer assumed to take place only in the classroom or on the campus, as more and more learning is shifted to the workplace, the home, the library, or the network.

Higher education once catered mainly to full-time undergraduates: single 18- to 22-year-olds living on campus and relying on their parents to pay most college expenses. Today, according to

recent data from the National Center for Education Statistics, approximately 25 percent of college students fit this traditional student profile. In fact, higher education serves a wide range of students and markets, from traditional full-time undergraduates to working adults taking courses via distance education.[18]

In the 1999–2000 school year, about 1.5 million of the 19 million students in higher education took at least one online distance education course.[19] In 2002, an estimated 84 percent of four-year institutions offered at least one distance education course.[20] As these numbers rise, so will the need for more digital campuses, online services, and flexible semesters.

A major component of education's redesign must include helping students learn what they need when they need it. The more colleges and universities experiment with the traditional academic calendar and style of delivery, the more people will have access to programs that allow them to remain competitive in the workplace and enjoy the benefits of higher education.

OUTCOME-ORIENTED EDUCATION

Increasingly, businesses want workers with specifically targeted and certifiable skills.[21] To achieve this, America's educational system needs an assessment system that measures performance and assures greater accountability.[22]

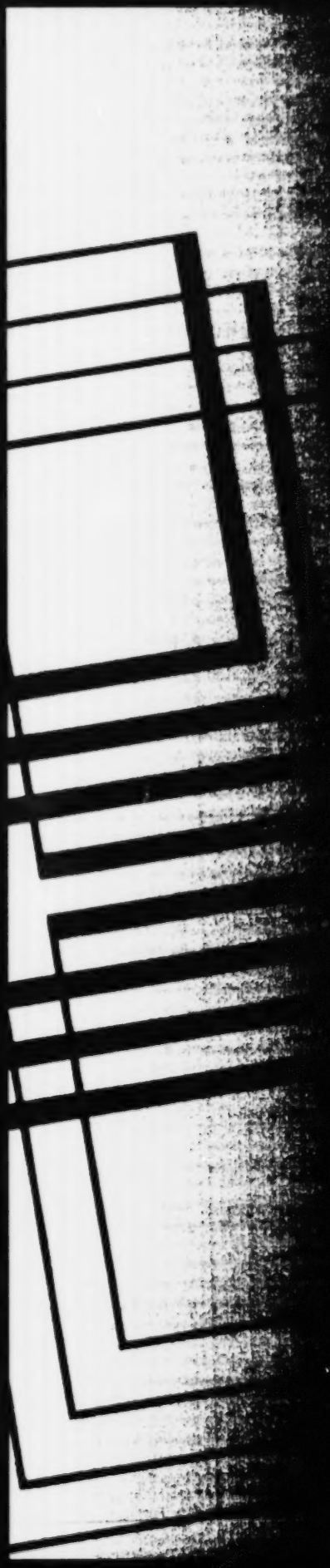
For example, more and more higher education institutions are requiring students to produce "portfolios" of projects and class work that demonstrate proficiency in adult roles. Hands-on learning opportunities, such as internships and mentoring projects, can help students apply their learning to work environments.

With the increased need for workers to be lifelong learners so that they can upgrade their job skills, replace those that are obsolete, and respond to other workplace realities, programs that can be combined with work must efficiently provide certifiable and tangible skills based on measurable standards.

As education is redesigned, students will gain a clearer understanding of the career outcome of specific higher education programs, as well as the responsibilities required of the individual, higher education institutions, and the employer to maintain a high level of workforce competitiveness.

Incorporating one or more of these aspects of redesign can fundamentally enhance learning and outcomes. For example, the Pew Foundation's Learning and Technology Program's studies on improving the cost, quality, and accessibility of large enrollment courses found that learning can be improved when instruction is learner-centered, individualized, interactive, and outcome-oriented.[23]

As a country, the United States must create a national strategic plan for achieving these learning goals. Creating an effective plan will require leadership at the highest levels, with input from federal and state governments as well as the private and public sectors. To make sure solutions are delivered on the scale needed, the strategic plan must outline how change can be accomplished and what technological investments must be made to reach faculty, students, and administrators across the country.



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"Innovative approaches give an indication of how learning will be transformed in the future to keep pace with rapid developments. These cutting-edge examples of educational redesign also can be adapted by other institutions. And states can build on these proven efforts, too, to accelerate the process of closing the gap between knowledge and skills as soon as possible."

Change in Learning Is Underway

Although a clearly defined strategic plan for learning has yet to be articulated, some educational institutions have already started to redesign education at the local level. Innovative approaches give an indication of how learning will be transformed in the future to keep pace with rapid developments. These cutting-edge examples of educational redesign also can be adapted by other institutions. And states can build on these proven efforts, too, to accelerate the process of closing the gap between knowledge and skills as soon as possible.

Leading innovators are fundamentally altering centuries-old learning techniques, challenging basic assumptions about learning, and transforming the way teachers instruct, students learn, and learning occurs.

Some of the changes entail changing the way class time is used, altering the types of activities in which students engage, or creating entirely new forms of content.

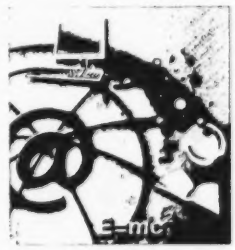
Some of the most innovative solutions have required fundamentally rethinking semesters, credits, delivery, and management. For example, the U.S. Army is plugging into the digital age and offering online, learner-centered, interactive, individualized, and flexible learning services to soldiers worldwide. The degree of web-based education in other organizations ranges from offering one or two online courses to providing all content online and tapping a worldwide faculty and student base.

Certain changes are specific to courses or student needs; institutions use a modularized course approach to allow students to advance to higher levels of proficiency at their own pace, which reduces failure rates. Several of the most effective programs involve collaboration between industry and higher education.

Some institutions have created innovative curriculum and content that could not be developed without technology. In these new learning models, the teacher's role is expanded. At innovative institutions, the faculty are trained as "expert learners" to link technology, teaching, and student learning.

As the following examples illustrate, when institutions create relevant, engaging content, and allow the individual to interact to pursue various learning styles and set his or her own pace in achieving an educational objective, education is more effectively delivered and learning is enhanced.

These innovative programs show that solutions to the problem of closing the "skills gap" and preparing a workforce for the future do exist. Yet, they also underscore the barriers to change. Most important is the fact that these solutions require significant investment, often from sources already strapped for funds.



Some of the changes entail changing the way class time is used, altering the types of activities in which students engage, or creating entirely new forms of content.

The Learner-Centered Environment: Rio Salado Community College

By looking at the traditional academic calendar in a new way, Rio Salado Community College in Tempe, Arizona, was able to expand its services exponentially to serve more than 34,000 credit students annually. Each year, Rio Salado has created 26 different enrollment periods with a new class starting every two weeks. This makes learning much more accessible to adults whose schedules do not revolve around the traditional academic calendar.

Today, Rio Salado boasts test results as good as or better than those posted by traditional students, higher retention rates, and greater student satisfaction. Now, students who were previously underserved are learning new things in new ways—taking advantage of courses offered anytime and anyplace.

Without the use of technology, and the investment that makes it possible, Rio Salado could neither afford nor implement the organizational changes necessary to create a truly learner-centered environment and meet what often are dramatically different individual student needs.

For more information, visit http://www.rio.maricopa.edu.

Matching Individual Abilities to Learning Styles: Virginia Tech

Virginia Tech's *Math Emporium* is benefiting from investments in new technologies to individualize its program in linear algebra, resulting in increased math scores, decreased costs, and more self-directed learning. Students choose when to access course materials, what types of learning materials to use, and the pace of the coursework.

Rather than regularly scheduling classes, the *Math Emporium* has developed online interactive tutorials, computational exercises, and practice exercises with video solutions to frequently asked questions and online quizzes.

Using a 500-workstation learning center, organizers have provided more options for self-directed study than are possible in traditional lecture-and-lab courses. The university reports that scores in math have risen 17.4 percent and the failure rate has dropped by 39 percent. At the same time, the cost-per-student was reduced from $91 to $21, resulting in a projected annual operating cost reduction of $130,000.

For more information, visit http://www.emporium.vt.edu.

Broad-Scale Interactive Learning: The University of Illinois

The University of Illinois *BugScope* project is showing how hands-on experience can increase student motivation and learning. *BugScope* allows students using the Internet to interact with an otherwise unavailable expensive electron microscope to view and manipulate insects that the students have personally collected.

The *BugScope* project provides access to faculty and equipment for K–12 students nationwide. Studies have shown that inquiry-based projects such as *BugScope* help students learn a topic faster and more thoroughly.

BugScope is a cost-effective example that demonstrates how one university's investment can be leveraged to provide an experiential and interactive learning environment to thousands of learners throughout the country.

For more information, visit http://bugscope.beckman.uiuc.edu.

Teachers as Expert Learners: Georgetown University

Looking beyond narrow faculty "training" models, Georgetown University's *Center for New Designs in Learning and Scholarship* (CNDLS) is redefining what it means to engage faculty as partners in the transformation of learning through technology. CNDLS is pioneering programs that view university-level teachers as expert learners, and not merely content providers.

The effective use of new technologies in teaching depends largely on faculty being taught how to use the evidence of improved student learning to support scalable and sustainable innovation. Through local activity at Georgetown, and national projects like the *Visible Knowledge Project*, CNDLS is developing this approach in both face-to-face and online faculty workshops, emphasizing the linkages among technology, teaching, and student learning to build communities of educators engaged in meaningful change.

For more information, visit http://cndls.georgetown.edu.

Flexible Access to Address the Skills Shortage: Pace University

The telecommunications industry, facing a critical shortage of skilled technicians, needed to allow workers to upgrade specific skill sets in narrow windows of time. Industry leaders turned to technology to create a flexible, online 24/7 learning environment to enable workers to upgrade their skills. They then turned to Pace University and invested in creating a new school, the *National Coalition for Telecommunications Education and Learning* (NACTEL).

Students of the school can hold down full-time jobs (which, in the telecommunications sector, often entail significant overtime) and still manage to study and work toward their college degrees. New learning is taking place where it wasn't previously possible.

The industry leaders and Pace University co-developed a four-year degree program of courses that provide practical knowledge and also meet academic requirements. Using industry-supported investment in technology to provide flexible access to an educational environment, the program has helped workers increase their pay and marketability and helped the industry respond to a critical skills shortage.

For more information, visit http://csis.pace.edu/nactel.

Developing Global Consciousness: Fairleigh Dickinson University

Fairleigh Dickinson University (FDU) was one of the first institutions to make global education a cornerstone of its mission. FDU has formed partnerships and affiliations with institutions overseas to enhance its faculty and student base. In fall 2001, FDU, which has campuses in New Jersey and England, became the first university to require that all undergraduate students take one online course per year to allow students to interact with students and faculty from around the world.

The university features one of the largest international student bodies in the region, with more than 900 students from more than 70 countries. In 2002, FDU established a lecture series in which current and former United Nations ambassadors present programs, teach courses on campus, and broadcast discussions. FDU's link to the United Nations allows students unique access to world leaders and challenges students to respond to real situations with the input of international perspectives.

For more information, visit http://www.globaleducation.edu.

Outcomes-Oriented Learning: Ohio State University

By thoughtfully leveraging scarce public and private resources, Ohio State University (OSU) has effectively created an outcomes-oriented learning process that decreases failure rates, dropout rates, and class repetition, and, in turn, creates more space for additional students. OSU's *Introductory Statistical Concepts* course serves more than 3,000 students a year.

Before enrolling in the class, most students had satisfactorily completed initial course units, but 20 percent of the students enrolled in statistics had to repeat the course in a subsequent quarter. Using new learning technologies, students can now earn from one to five credits based on successful modularized course content. By implementing a "buffet menu" strategy, the university offers students a choice of interchangeable paths to meet each course objective.

By requiring students to demonstrate a passing-level proficiency in one unit before proceeding to the next, the university can identify and address severe deficiencies early and lower failure and withdrawal rates.

OSU estimates that this effort eliminates one-fourth of the course repetitions, opening slots for an additional 150 students per year. OSU further estimates a 31 percent cost-per-student savings, producing a total annual savings of $194,554 when extended to all 3,250 students across its campuses.

For more information, visit http://www.stat.ohio-state.edu/~stat135.

Creating New Content Online: The University of California, Berkeley

The University of California, Berkeley (UC Berkeley), is showing how the classroom can be transformed into a learning dynamo. *Chemistry 1A* is UC Berkeley's largest course, serving more than half the freshman class: 2,100 students a year. Before the university identified technologies that could transform the class, more than 100 teaching and support staff were required to teach and manage the course.

The course changes include using online quizzes with automatic grading and immediate feedback; enhancing lectures with graphics and animation, and providing archival and live lectures online; applying software to give professors immediate feedback; and combining an online lab manual with animated, interactive exercises for future laboratory experiments.

As a result, the changes in *Chemistry 1A* are helping to improve teaching and learning by engaging students in a more robust dialogue about chemistry concepts and theories.

For more information, visit http://www.cchem.berkeley.edu.

Education and Industry Partnerships: Peter Kiewit Institute, University of Nebraska

Through a partnership between Peter Kiewit Institute (PKI), located at the University of Nebraska, and the private sector, students can not only receive a comprehensive education in information technology (IT) and engineering, but also obtain the business and life skills demanded in today's workplaces. The curriculum was designed by industry representatives working closely with educators to ensure a match between learning needs and educational outcomes.

Through an unusual mix of creative and close partnerships with business and industry, the Institute offers some of the most advanced technology available. In fact, more than 150 corporations work with PKI. As a result, PKI has become a tool for economic development and draws new businesses to the area because of the Institute's unique resources and talent.

Most students have job offers by junior year and end up with top salaries when they graduate. Dennis Smith, President of the University of Nebraska, says that if the resources for investment were available, the entire curriculum of the university could be transformed.

For more information, visit http://www.pki.uneb.edu.

NEXT STEPS IN BUILDING CHANGE

Once again, these examples are evidence of a movement among innovative institutions to create educational systems that are more responsive to the individual needs and styles of learning and more attuned to the realities of the workplace. When institutions find ways to increase access and flexibility to programs, individualize learning, and take other steps toward the redesign of education, students can not only complete career specific requirements, but also attain the flexible lifelong learning skills they need to remain competitive in the workplace.

Finding solutions to educational challenges is not enough, however. Higher education, the business community, and policy makers must also ensure that these solutions are widely available. Regional centers, innovative government programs, and efforts to educate and disseminate best practices can provide a national impetus for change, which can address institutional, financial, and technological barriers and make learning goals a reality.

When institutions find ways to increase access and flexibility to programs, individualize learning, and take other steps toward the redesign of education, students can not only complete career specific requirements, but also attain the flexible lifelong learning skills they need to remain competitive in the workplace.

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"When all the elements of redesigne education are compared to those solutions that use information technology and those that do not, the important role of IT becomes obvious."

The Role of Technology and a Vision for 2010

To create change on the scale needed, higher education cannot expect to redesign education one institution at a time. Educators know what approaches work best in the classroom to enhance learning, but it will take a realistic plan, concerted efforts, and significant investments to combine the best aspects of the traditional classroom model and new technologies.

SCALING SOLUTIONS

Technology can help promote individualized, flexible learning—the basis of redesigned education—through such methods as modularized learning units, simulations, communications between faculty and students, and others.

When all the elements of redesigned education are compared to those solutions that use information technology and those that do not, the important role of IT becomes obvious.

For example, to create learner-centered environments and provide the services that support effective learning without the help of IT would require a reorganization of offices and departments—not to mention a physical relocation in some cases. But with technology, faculty and students can have instant access and instant response through e-mail and other options for feedback and input in research and education.

To provide more individualized learning without IT, colleges and universities would need to provide more instructor time, more faculty, and smaller classes, which could mean construction of new classrooms. IT, however, can match learning with individual needs through modularized courses, provide automation of mundane and time-consuming tasks, and free up faculty time for more effective uses. Technology also can help provide the content changes needed for redesign, such as creating digital versions of historic and other materials from federal archives and other sources.

THE BLENDED MODEL

Based on the experience of higher education in the process so far, technology will by no means replace the traditional teacher-student relationship. In fact, technological innovations, such as instant messaging and expanding the digital campus, have been found to require more, not less, faculty time as "office hours" and student-teacher conferences extend beyond face-to-face consultations.

The most successful education models are those that blend the best aspects of both the traditional classroom and technological innovations. This blended model holds the most promise for making change on the scale needed to help quickly build a nation of learners.

Most important, the blended model reflects a realistic view of what information technology can and cannot do to improve education. If used by teachers in ways commensurate with its promise, technology can be an effective tool in redesigning education. At the same time, if enough investments are made in infrastructure, higher education can make change on the scale needed.

INFRASTRUCTURE INVESTMENTS

Higher education needs infrastructure investments in order to fully use technology as an indispensable tool for capitalizing on the benefits of the redesign of learning. With a technological infrastructure in place, higher education can create new learning models and achieve learning gains more effectively, efficiently, and economically.

The business sector has already recognized the need for making an initial investment in infrastructure to scale technological change. After all, following the invention of the personal computer, it took 15 years of investment in technology infrastructure to enable companies to fundamentally redesign the way business was done. Similarly, the right technological infrastructure is

BLENDED TECHNOLOGY TEACHING MODELS

Technology offers a variety of new models for teachers to reach learners. Rather than one particular design, the blended approach spans a wide range of models. Students may be in the classroom, across the campus, in the field, or around the world. What they have in common is combining the best of classroom and online technologies to allow the teacher to maximize learning.

CLASSROOM BLENDED MODEL:

With technology in the classroom, teachers now have the ability to:

- "Beam in" distant experts to classrooms for live discussions.
- Use virtual or distant laboratories directly in lectures.
- Allow students to look up supporting resources while in class.
- Post lectures and assignments on the Internet.
- Receive immediate feedback from students during a lecture.

ONLINE BLENDED MODEL:

Using online learning models, teachers can:

- Supplement online materials with live online lectures.
- Meet with students online in small groups at set times.
- Answer student questions asynchronously when time is convenient.
- Provide more individualized attention when students are struggling.

REAL WORLD BLENDED MODEL:

Using real world tools, teachers can:

- Use the work environment as the classroom.
- Combine physical classroom or online lessons with real world experiences.
- Use students in one location with one experience to teach students in other locations.

necessary before broad change and efficiency gains can occur in education.

The greatest benefits of technological innovation, however, are not the cost savings but the learning gains. Large payoffs come from the automation of mundane processes, such as administering quizzes and posting content online. These changes allow students and faculty to focus more of their time on critical learning skills, including analysis, synthesis, and problem solving.

Recognizing the importance of a robust technological infrastructure for learning, the nation has made substantial new investments in K–12 technology infrastructure over the last five years.[xv] However, despite similar learning potential in higher education, investments in its technology needs lag behind K–12 investments.[xvi] BHEF believes that, at a minimum, the same level of investment should be made in higher education technology.

Many higher education classrooms and other learning environments lack Internet access, now considered as much an essential learning tool as textbooks and chalkboards. According to a Market Data Retrieval survey, more than one-third of classrooms lack basic Internet access.[xvii]

Most higher education institutions do not have the financial resources to aggressively pursue IT-enabled improvements. Alarmingly, 25 percent of public universities and community colleges are reporting cuts in their academic computing budgets.[xviii] Under-funded academic IT budgets are jeopardizing institutional ability even to maintain current systems, let alone make the kind of long-term investments necessary for dramatic reform.

Educators estimate that to catch up with the pace of technological innovation, institutions should double their current average investment in IT to 10 percent of their overall budget, or about $2,000 per student, teacher, or staff member.

Educators also are increasingly alarmed at wide disparities in the deployment of IT infrastructure among institutions of higher learning. For instance, community colleges, which enroll proportionately larger percentages of minority students, have fewer students who own their own computers—39 percent compared with 58 percent of all postsecondary students.[xix] In addition, college students nationally are more than twice as likely to have access to a college-owned computer as their counterparts at historically black private colleges and universities.[xx]

Many investments in technology relate to human resources as well, such as help desk personnel, web designers, information librarians, and network engineers, an area that is critical to successful technological integration.

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Likewise, professional development for faculty is instrumental to successfully integrate technology into the learning process. The human resources needed for a successful digital environment can take up to half of an IT budget. The training and support component is not a one-time investment in transforming learning, but an ongoing one.

State and federal officials will need to address these and other technological investments necessary to allow the country to maintain the delivery of high-quality education so vitally needed to meet its global economic challenges.

A VISION FOR 2010

In summary, the urgency and magnitude of the challenge to education suggest the need for a swift and substantial new commitment to becoming a nation of learners. Leaders from sectors throughout the country are challenged to move this learning campaign forward.

Higher education must redesign itself to meet the learning standards of today's world. Education must be engaging, flexible, and interactive. Forward-thinking institutions that can lead the way must pioneer innovative new efforts and become champions of redesign and learning.

Lastly, this effort requires a massive new investment in technology infrastructure that will allow U.S. colleges and universities to scale these learning solutions to a broad expanse of learning environments.

If these changes are made now, then by the year 2010, two generations of students will have had the benefit of a higher education system that is more sensitive to workplace realities and more attuned to creating a nation of learners equipped with essential, highly developed learning tools. If Americans embrace the changes needed for education, this 21st century generation will have the analytical skills, the leadership abilities, and other lifelong learning skills and attributes needed to adapt to workplace realities and changes.

By 2010, students will take it as a matter of course that they will need to continually upgrade job-related skills and use technological innovations that are widely available. Adults will have learned how to learn. They will be able to seek out new information, courses, and skill sets throughout their lives.

Teachers will be able to focus more effectively on providing students with new analytical, critical thinking, and problem-solving skills for the highest quality education possible. Institutions will be able to enhance the effectiveness of the education they provide and increase the number of students they serve.

And the nation will be catapulted into a new era of learning opportunity and economic growth.

THE CHALLENGE BY 2010

- Every campus will have redesigned its coursework.
- Every student will have access to individualized and customized strategies for his or her specific education needs.
- Every classroom on every campus will have access to the online and off-line tools that students need.
- Every graduate will be assessed not only on his or her academic achievement, but also on his or her skills in leadership, teamwork, problem solving, time management, self-management, adaptability, analytical thinking, global consciousness, and basic communication (listening, speaking, reading, and writing).

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"Change cannot happen in a vacuum. An undertaking of this magnitude can happen only through committed leadership with vision and purpose at the highest level. To meet these goals by 2010, federal leaders must rise to this challenge, refocusing existing education and training efforts, and creating the new policies, priorities, and programs that will transform the United States into a nation of learners."

America's Future as a Nation of Learners: Policy Recommendations

Based on the findings in this report, BHEF urges policy makers to usher in a new era of learning by taking several specific, critical steps in two key areas: developing new leadership and vision, and focusing on learning redesign and dissemination.[xv]

DEVELOPING NEW LEADERSHIP AND VISION

If the United States is to achieve its full potential, then fundamentally changing learning must be one of the nation's overarching challenges for the next decade. Change cannot happen in a vacuum. An undertaking of this magnitude can happen only through committed leadership with vision and purpose at the highest level. To meet these goals by 2010, federal leaders must rise to this challenge, refocusing existing education and training efforts, and creating the new policies, priorities, and programs that will transform the United States into a nation of learners.

Creating a Presidential Commission on Learning: As a result, BHEF recommends that the president create the President's Nation of Learners Commission to:

- Identify ways to increase the educational and teaching expertise necessary for dramatically improving learning.
- Quantify the magnitude of technology infrastructure investments needed to bring those methods to fruition.
- Address the role that higher education must play in reaching this goal by 2010.[xvi]

The Commission, comprised of representatives from Congress, the private sector, education, state and local government, and representatives from the Departments of Commerce, Labor, Education, and other relevant agencies, would make specific recommendations on a strategic plan to the president, Congress, and the American people by no later than the end of 2004.

The plan should include a national "learning R&D" (research and development) strategy, which would provide recommendations on the amount of R&D necessary to develop new teaching and learning models that can maximize Americans' learning potential, on a scale analogous to the R&D investments made in other fields.

The plan should include infrastructure objectives with specific recommendations for achieving national learning infrastructure goals[xvii] and a strategy for the federal government to make its own novel and important learning resources[xviii] available to the learning public.

This blueprint also should outline an implementation strategy, so that the United States can achieve the goal of becoming a nation of learners by 2010.

Finally, to ensure the plan's success and catapult this effort, the Commission must identify ways to combine existing agency efforts with newly identified resources.

FOCUSING ON LEARNING REDESIGN AND DISSEMINATION

As this report has shown, becoming a nation of learners requires fundamentally redesigning and disseminating new learning approaches. If Americans are to fundamentally improve learning, then they need to better understand what works and what does not and deliver the right solutions to those who can put them to work.

When confronted with similar research and dissemination challenges in the past in health care, agriculture, energy, and defense, the federal government created the National Institutes of Health (NIH), the Department of Agriculture's extension service, the nation's regional national labs, and the Defense Advanced Research Projects Agency (DARPA), respectively, to find new and innovative solutions and put them to work. A similar new federal effort is needed in education to support the research, dissemination, and training needed to make new learning models possible. Furthermore, an educational effort needs to be regionally focused to better pool local resources, talent, training, and expertise.

Creating New Regional Innovation Centers for Learning Redesign: BHEF proposes that Congress create new regional centers of learning excellence that can specifically focus on improving and redesigning learning. These regional centers will help redesign learning by:

- Pushing the frontiers of learning science with new research.
- Exploring the role that the latest technology advancements can play in providing more effective learning techniques.
- Developing new innovative learning methods and models.
- Bringing together new partnerships to support new learning models.
- Providing appropriate training and retraining for faculty and students for implementing developed methods.
- Disseminating the best models and methods to higher education and other institutions to put them into practice.

Like NIH, DARPA, and the national labs, these centers would bring together the brightest minds from academia, the private sector, and government to search for new ways to further increase the effectiveness of learning. The centers will need to constantly look for and work with the most innovative learning models that pioneering institutions are developing. BHEF recommends that they be modeled after the newly created regional Math and Science Centers established by Congress.

Creating New Grants for Institutions to Become Early Adopters: This report has shown how some pioneering institutions are already making headway in adopting new approaches to teaching and learning. The United States must enable more forward-looking institutions to become champions of redesign and learning by allowing them to make the pervasive changes necessary.

In response, BHEF urges Congress to create a new federal Learning and Networking (LAN) Grant Program to promote pioneering projects and innovative efforts on campuses throughout the country.

The grant program, administered by the Department of Education, would permit specific campuses to improve teaching across a department or a campus. It would help make learning more efficient and effective by providing higher education institutions with new resources to assist them in drawing upon the expertise of the regional centers and implementing comprehensive learning redesign.

Grants could help institutions redesign content, courses, and learning processes; build and sustain a robust technological infrastructure; and provide other necessary resources for achieving widespread learning transformation. By ensuring that institutions can become early adopters and use the technologies that help them to achieve these goals, the grants can fundamentally transform the way teachers teach, students learn, and education is delivered.

Taken together, these three recommendations can propel America into a new era of opportunity. The American dream itself is based on the belief that with the right education and skills, people can fulfill their potential, companies can compete and win, and the nation can prosper. More than ever, it is in the interest of the United States to create a nation of learners ready to tackle the unpredictable challenges of the 21st century.

Endnotes

i Including reports by the National Alliance of Business, the Competitiveness Council, and the American Council on Education.

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iii IBM Mindspan Solutions, *Coopers & Lybrand Trendsetters Barometer,* http://www.ibm.com.

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v Carnevale and Desrochers, *The Missing Middle,* p. 23.

vi Michael Moe, *The Knowledge Web,* Merrill Lynch, May 2000, p. 34. Wage gap is from 1980 to 1998.

vii U.S. Census Bureau, Current Population Surveys, March 1998, 1999, and 2000. *The Big Payoff: Educational Attainment and Synthetic Estimates of Work-Life Earning,* July 2002.

viii *The Power of the Internet for Learning: Moving from Promise to Practice, Report of the Web-Based Education Commission,* December 2000. The Commission issued an urgent call to action for producing high-quality, web-based learning content.

ix *The Condition of Education 2002,* U.S. Department of Education, National Center for Education Statistics, http://nces.ed.gov/pubsearch/pubsinfo.asp.

x General Accounting Office, *Distance Education: Growth in Distance Education Programs and Implications for Federal Education Policy,* September 26, 2002.

xi Ibid.

xii Sally M. Johnstone, Peter Ewell, and Karen Paulson, *Student Learning as Academic Currency, Fourth in a Series on Distributed Education: Challenges, Choices, and a New Environment,* American Council on Education and EDUCAUSE, 2002. The report recognized the challenges in measuring academic achievement and the need to shift from a seat time–based approach to a competency-based approach to academic accounting.

xiii Ibid.

xiv Carol Twigg, *Improving Learning & Reducing Costs: Redesigning Large-Enrollment Courses,* The Pew Learning and Technology Program, Center for Academic Transformation, Rensselaer Polytechnic Institute, 1999, pp. 1–26.

xv New K–12 federal technology programs introduced in the last five years include the $2.25 billion a year E-Rate program, the $2 billion Technology Literacy Challenge Fund, and the $1 billion Ed-Tech block grant program.

xvi Quality Education Data's new *School Market Trends: District Technology Forecast 2001-2002* projects total technology spending among U.S. public K–12 school districts for the 2001-02 school year of $7.05 billion (plus or minus 12 percent). Market Data Retrieval's *College Technology Review* projected technology spending in postsecondary institutions will reach $4.99 billion for the 2001–02 school year.

xvii Market Data Retrieval, *2002 College Technology Review.* Sixty-four percent of classrooms had Internet access in 2001 and 2002.

xviii Kenneth C. Green, *The 2001 Campus Computing Survey,* http://www.campuscomputing.net.

xix Green, *The 2000 Campus Computing Survey.*

xx United Negro College Fund. One computer exists for every 2.6 students in U.S. higher education institutions versus one for every six students at UNCF colleges and universities. E-testimony to the Web-based Education Commission, August 28, 2000, http://www.webcommission.org/directory; see also http://www.uncf.org.

xxi BHEF acknowledges the thoughtful policy recommendations on the use of information technology in higher education that have been proposed by the American Council on Education, the Career College Association, the Digital Promise, EDUCAUSE, NASULGC, and the Web-based Education Commission.

xxii See table laying out *The Challenge by 2010,* p. 27.

xxiii National infrastructure goals should include: high-speed Internet connectivity to every higher education classroom, dormitory, laboratory, and technology center by 2008 (100 megabytes access); ubiquitous wireless broadband access throughout higher education campuses by 2008; and doubling the number of campuses connected to the Internet by 2008.

xxiv The federal government can help unlock the full potential of technology-based learning by digitizing and making available the millions of historical, scientific, and educational materials in its vast collections held by the Smithsonian Institution, the Corporation for Public Broadcasting, the National Archives, NASA, the Library of Congress, and elsewhere.

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